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ABSTRACT

A research project was undertaken to develop a handbook for secondary school industrial arts programs in North Dakota relative to the educational specifications on facilities and instructional equipment. Among the procedures used to determine these needs were a literature search for such guidelines in other states, a review of the restructured state curriculum guide and master plan for industrial arts, and recommendations for laboratory sizes and types, environmental provisions and utilities, and equipment. It was found that the physical facility must plan for (1) student exploration in the use of tools, materials, and equipment with emphasis on problem solving either on an individual or group basis; (2) the state curriculum planning sequence for junior and senior high schools; (3) one of three types of laboratories: dual-cluster, general cluster, or comprehensive; (4) space requirements according to adequate safety clearance for aisles and traffic patterns; (5) complete visibility for the instructor; (6) laboratory placement by intradepartmental relationships; (7) laboratory flexibility and adaptability; and (8) integrated utility systems. As for equipment selection, it was concluded that the major criteria include potential for educational development of students, valid production function, safety and ease of operation, quality, and simplicity. In order to plan sufficient space for each piece of equipment, it was found that equipment selection should precede layout plans for arranging equipment.

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FINAL REPORT

EDUCATIONAL SPECIFICATIONS HANDBOOK
ON FACILITIES AND INSTRUCTIONAL
EQUIPMENT FOR NORTH DAKOTA SECONDARY
SCHOOL INDUSTRIAL ARTS PROGRAMS

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U.S. DEPARTMENT OF HEALTH,
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TABLE OF CONTENTS

	<u>Page</u>
ACKNOWLEDGMENTS -----	11
ABSTRACT -----	111
METHOD & PROCEDURES -----	1
RESULTS AND FINDINGS -----	2
- Industrial Arts Activities	
- Procedure for Planning New or Remodeling	
Existing Industrial Arts Facilities	
- Types of Laboratories	
- Laboratory Space Requirements	
- Spatial Requirements	
- General Considerations for Industrial Arts	
Facilities	
- Instructional Equipment Selection	
- Selection Criteria & Layout	
SUMMARY -----	23
REFERENCES -----	25

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This RCU project, to develop a handbook on educational specifications for industrial arts in North Dakota secondary schools, would not have been possible without the contributions of the following individuals. These individuals gave freely of their time and efforts toward the goal of good planning to enhance the teaching/learning process through well designed physical facilities.

The project director wishes to thank the North Dakota State Board for Vocational Education for providing the necessary financial support. A special thanks to Dr. Donald Eshelby (State Research and Curriculum Coordinator) and Mr. Ernest Breznay (State Supervisor for Industrial Arts) for their able assistance and direction in the planning and operation of this project.

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ABSTRACT

The purpose of this project was to develop a handbook for secondary school industrial arts programs in the state of North Dakota relative to the educational specifications on facilities and instructional equipment.

Today is an era of change and innovation in industrial arts education on the national basis as well as in the state of North Dakota. This change has a direct bearing on the nature of the learning environment and instructional equipment necessary to conduct a viable industrial arts program in secondary schools.

The educational and facility specification guidelines prepared through this project are intended principally to assist industrial arts teachers, school administrators and architects in planning and designing functional facilities for instructional purposes. It will also provide assistance in remodeling existing facilities and be used as a guide for determining the reimbursement of industrial arts equipment and the establishment of new programs.

The handbook entitled Educational Specifications Handbook on Facilities and Instructional Equipment for North Dakota Secondary School Industrial Arts Programs includes five sections: (1) Educational Planning, specifications and definitions; (2) Type, size, and relationship of laboratories; (3) General and environmental considerations; (4) Equipment recommendations for the technical clusters of graphic communications, manufacturing, construction, and energy/power; and (5) Selected industrial arts facility layout plans.

The specification handbook provides guidelines on a general basis to aid teachers and administrators in planning learning environments that will enhance the new restructured secondary school industrial arts

curriculum in North Dakota. The information is not intended to provide specifications for any one kind of facility but to offer basic suggestions pertinent to the planning of any school industrial arts laboratory. The ideas suggested on physical facilities follow the objectives of industrial arts education as outlined in the North Dakota Industrial Arts Curriculum Guide, 1977.

The handbook on specifications and recommended instructional equipment lists is available through the Department of Industrial Technology, University of North Dakota, Grand Forks, 58202.

METHOD AND PROCEDURE

The general design for the research project was descriptive in nature and included the following steps to complete the project of preparing an educational specifications handbook for industrial arts education:

1. Literature search to determine what educational specification guidelines are provided by other states for planning learning environments in industrial education.
2. Analysis and synthesis of the North Dakota Industrial Arts Curriculum Guide and the Suggested Master Plan to determine what instructional equipment is necessary to teach the content identified within the above two publications.
3. The compilation of educational planning guidelines and definitions pertinent to designing effective learning environments for industrial arts education.
4. Recommendations for the selection of instructional equipment in terms of quantity and quality for both the Junior High Exploratory and the Senior High -- Specialization programs in industrial arts education.
5. Recommendations and guidelines on laboratory spacial relationships, recommended sizes and types.
6. General guidelines on providing adequate environmental provisions and utilities needed to conduct an effective program.
7. Preparation of selected physical facility layout that can serve as a guide in designing new facilities and remodeling existing facilities.

The last phase of the project consisted of writing, printing, and

distributing a handbook entitled Educational Specifications Handbook on Facilities and Instructional Equipment for North Dakota Secondary School Industrial Arts Programs. Three hundred copies were printed in the Graphic Communications Laboratory within the Department of Industrial Technology at the University of North Dakota under the direction of Dr. Wan-Lee Cheng. Copies of the completed guide were distributed to every secondary public school in the state of North Dakota.

FINDINGS AND ANALYSIS

The industrial arts instructor with assistance of professional consultants in the field of industrial arts, is the best qualified person in the local community to outline the industrial arts curriculum within the framework of the state guide. It is the instructor who identifies the learning activities and arranges the learning environment in such a manner as to facilitate learning and to promote optimum educational results.

Every industrial arts teacher should continuously strive toward the most efficient arrangement of instructional tools and equipment in the laboratory. While some teachers may never be called upon to design a new industrial arts physical facility or to rehabilitate an existing one, each must face the problem of providing the best possible physical arrangement of the learning environment in which learning is to take place.

The goal of environmental design is to provide physical facilities that will support envisioned and desired curricular programs and instructional actions. This supportive role of facilities requires that curricular programs be conceptualized and articulated in a manner that

will clearly identify (a) the goals and philosophy guiding the program; (b) the activities and behaviors to be staged within the program and its facility; and (c) the procedures and sequences used for arranging the learning experiences and activities.

Industrial Arts Learning Activities

Physical facilities are provided to educate young children and adolescents through laboratory and classroom activity-oriented experiences. The experiences are designed to assist in the formation of concepts related to industry and technology. These experiences are intended to have the learner participate actively in the conceiving, designing, planning, and producing goods using materials common to daily life. The student is exposed to activities for--

- 1) experiencing industrial technology -
through planning, designing, experimenting, constructing, and operation using ideas, materials, tools, processes, products, and energies;
- 2) learning about industry and technology -
their origin, development, advance, and impact on man, environment, and culture;
their technical, social, economic, occupational, cultural, recreational nature, influences, and outcomes;
their consequences for the individual as a citizen, consumer, and worker.

The physical facility must be designed to allow for student exploration in the use of tools, materials and equipment with emphasis on problem solving. The nature of the activity may be on an individual and group basis. Specific tool usage and problem solving can be done within a context

of application. Students assume such roles as product designers, project engineers, production line workers, researchers, builders, managers, in-plant printers, model makers. The work of these roles will be coordinated through larger group efforts in graphic communications, production (manufacturing/construction), energy/power and transportation.

Spaces within a facility will have high and low usages at different times of a day and hour. Consequently, facilities should be designed to allow for flexibility of scheduling various activities that can be run simultaneously. This is particularly so at the junior high exploratory program and in small schools with only one industrial arts instructor. Regardless of the size considered as a functioning "whole" with identifiable operating "parts". The sum of these parts represent the total learning environment for all technical elements with a physical facility.

Because of the ever changing nature of technology and occupations, students must be educated to be ready and able to adapt to new occupations. This means establishing an environment which will make a student aware of his future needs. This cannot be accomplished effectively working in only one or two technical areas or concentrations. Consequently, it is important that a conceptual/sequential curriculum structure be developed along with a facility that permits the student to be aware of the many elements of industry and technology. The physical facility should supplement and compliment the curriculum content by enabling the student to interrelate areas of concentration and move freely about the entire industrial arts facility complex.

The North Dakota Industrial Arts Curriculum Guide identifies three program operational levels: (1) awareness (Elementary School K-6); (2) career orientation and exploration (Junior High School -- grades 7-9); and (3) specialization (Senior High School -- grades 10-12).

Since no special physical facilities are commonly needed for the awareness level but are incorporated with the regular elementary curriculum and classroom, the emphasis in this guide is on the junior high and senior high school levels.

The curriculum planning sequence cannot be overly stressed because it becomes the key to a successful facility plan. It is applicable to new facilities or the modernization of existing facilities. Objectives should be written for the secondary levels to provide a totally coordinated program.

Level I Junior High Exploratory Curriculum -- The exploratory industrial arts curriculum for the junior high school is general in nature. It provides an opportunity for students to become oriented to the four major technical cluster areas: (1) Graphic Communications; (2) Manufacturing; (3) Construction; and (4) Energy/power. Each course is a semester in length and generally offered during the eighth and ninth grades. The exploratory cluster courses are preceded with a course entitled "Insights into Industry and Technology" which may be offered at the seventh grade level.

The emphasis for the Level I curriculum is placed on breadth of experiences rather than depth. It's content is organized in technical clusters for efficiency reasons so that students can conceptualize the "whole" of each area of concentration. If the school enrollment justifies only one industrial arts laboratory, it would be necessary to divide the laboratory by work modules to separate the technical areas. The laboratory needs to be equipped with instructional tools and equipment essential to conduct an exploratory program in all content areas. However, schools with larger enrollments might find it more efficient to

separate facilities for two or more closely related content areas; such as, production area (construction/manufacturing) and graphic communications joined with energy/power. This type of flexibility allows students to freely move from area to area.

Level II Senior High School Laboratory -- Generally, level II courses are designed as elective education beginning at the tenth grade and becoming more specialized at grades eleven and twelve. Courses at the senior high level promote unique interests, needs, and abilities of individual students rather than those common to all. Courses in each of the four technical content areas should be one or two semesters in length.

This level is not merely an extension or continuation of competencies developed in Level I, but in addition, it should provide an opportunity for the study of new phases related to the content experienced at Level I. Decisions regarding specific content, organization, and methodology are dependent upon the needs, abilities, and interests that characterize a given group of students to be served. Schools with large enrollments may offer specific courses derived from each of the three major cluster content areas identified in Level I (Graphic Communications, Production, and Energy/Power). In the smaller schools where enrollment doesn't warrant the offerings of specific courses, the needs may be met with the offering of individual technical problems.

Procedure for Planning New or Remodeling Existing Industrial Arts Facilities

Physical facilities to house an industrial arts program should be built as a result of a rationale and orderly planning process. The planning process culminates in written educational specifications to aid in communication with school administrators and the architect. They are the communicative media through which the teacher identifies the educational

program and factors which affect teaching and learning, thus providing a basis for the architect that he may use in the development of building plans and specifications.

Much of the information can be presented in straight-forward written composition; however, other information is best expressed and presented in diagram or tabular format. Good educational specifications for industrial arts facilities should include:

1. Departmental goals and objectives.
2. Number of pupils to be taught.
3. Educational program, including curricular offerings and activities of teaching/learning process.
4. Determine the size and types of laboratories needed.
5. Spatial relationship or coordination desired within various laboratories.
6. Environmental utility factors desired.
7. Equipment and furniture needs.

Well prepared education specifications are an instrument of good planning and design and, if used effectively, should result in functional facilities which can promote the desired educational program.

Types of Laboratories

Industrial arts education requires a laboratory setting as a unique learning situation in which the learner may experiment, test, construct, disassemble and assemble, design, create, imagine and study. The laboratories should be designed to enhance the curriculum and allow students to engage in a variety of learning situations.

The evolution of modern laboratories has been prompted by new interpretations of industrial arts education. The current trend toward

combining content areas of industrial arts dictates the need for three types of laboratories: (1) Comprehensive; (2) dual-cluster; and (3) general cluster type. Independent study areas may be established as modules within an industry and become integrated into a complete production problem by merely opening up the available space.

DUAL-CLUSTER LABORATORY -- The dual-cluster or concentration laboratory is designed and equipped for two technical cluster areas in a single room. For instance, the two recommended laboratories for a mid-size school or junior high are: (1) graphic communications/energy-power; and (2) production (construction/manufacturing). This approach is ideal for a two instructor program and may be used at both the junior and senior high level.

GENERAL CLUSTER LABORATORY -- This type of laboratory is planned and equipped to permit instruction in one technical cluster concentration in a room. Areas are planned so that activities may be carried on and explored in a general basis with provisions for indepth study. It is recommended for a large junior high school and senior high school where two or more industrial arts teachers are involved. A school may have three or four major laboratories depending upon the size of the enrollment. The common cluster laboratories for a given school may include: (1) Production (manufacturing/construction); (2) Graphic communications; and (3) Energy/power. This arrangement would permit exploratory experiences in a rotating program from one technical concentration to another during a school year. At the upper division or Level II program, each laboratory has provisions for indepth content on a semester or year course schedule.

Each of the above types of laboratories require auxiliary spaces to supplement and support the activities involved in a given program.

Additionally, some auxiliary spaces are needed to carry on activities which for safety reasons cannot be conducted in the main laboratory space. Supporting auxiliary spaces would include material/supply storage, project storage, office, student resource and planning center.

COMPREHENSIVE LABORATORY -- The comprehensive laboratory is one designed and equipped to permit instruction in all four concentrated cluster areas within one room. The size of the room may vary to permit supervision by one or two instructors depending on the number of students. It is recommended for small schools having only one laboratory for industrial arts. This type of facility should be designed to permit broad, exploratory work in several major industries. The cluster areas may be merely divided by work modules or by portable or foldable walls to divide processing areas from production or construction areas. This type of laboratory is very effective for the Level I curriculum. It is also adaptable for teaching individual technical problems for the Level II curriculum in small schools. A student may carry on independent study in a flexible environment which permits him/her freedom to move from process to process, material to material or whatever is needed to complete the study.

Laboratory Space Requirements

The three basic space requirements for an industrial arts program are: (1) classroom; (2) laboratory; (3) auxiliary spaces. The amount of space required for a given area is depended upon the school enrollment and nature of activities. Generally, it is determined by student station allowances with adequate safety clearance for circulation within a given area and the necessary aisle space and traffic patterns.

The following space allocations are recommended as ideal minimums for an optimum industrial arts education program. They are based on twenty-four students per class. All laboratories listed should not be interpreted as meaning they should exist in all programs but merely are given as alternatives. They very well may be combined in some cases, particularly for smaller schools, thereby reducing the total space required.

Space Allotment by Area -- The following chart indicates the minimum space allotment for each technical area per student (excluding auxiliary areas).

JUNIOR HIGH SCHOOL

Area	Sq. Ft. Per Student	Number of Students	Square Ft. Per Area
GRAPHIC COMMUNICATIONS	70	24	1640
MANUFACTURING	75	24	1800
CONSTRUCTION	75	24	1800
ENERGY/POWER	70	24	1640

Figure 1: Recommended Minimum Space Allotment -- Junior High

SENIOR HIGH SCHOOL

Area	Sq. Ft. Per Student	Number of Students	Square Ft. Per Area
GRAPHIC COMMUNICATION			
- Design/Drafting	50	24	1200
- Graphic Arts	75	24	1840
PRODUCTION			
- Materials Processing	100	24	2400
- Construction Fab/ Assembling	80	24	1920
ENERGY/POWER			
- Electricity/Electronics	75	24	1660
- Power	80	24	1920

Figure 2: Recommended Minimum Space Allotment -- Senior High

Spatial Relationships

The types and sizes of spaces to be included in an industrial arts physical facility are not the only factors that need to be considered when designing new learning environments. The shape of the spaces and their relationships to each other are equally important. The shape may vary from square or rectangular to other geometric shapes. Regardless of shape, the ultimate goal is to maximize efficiency in traffic patterns, safety, clustering of technical areas, flexibility and adaptability, conducive to good management. Any shape which does not permit complete visibility for the instructor from any position in the laboratory should be avoided. Areas with blind corners or isolated rooms invariably contribute to supervisory problems. Auxiliary rooms which are enclosed

by transparent partitions make it possible to keep students in sight at all times.

Spatial relationships among laboratories in an industrial arts facility should be as favorable as possible, particularly between those laboratories which are functionally related to each other. For example, manufacturing and construction laboratories should be placed adjacent to each other. Connecting doors or movable walls between such areas may allow for program versatility and interrelatedness. (See Figure 3). Whereas, graphic communication and energy/power can be adjacent to tie electronics and graphic communications to each other when individual laboratories are needed. In the case of one instructor and a single room for industrial arts, the same space relationships can be obtained through proper arrangement of modules with a given room. The laboratories or modules should be supported with a common classroom/resource center. These should be planned within or near the laboratories. In smaller schools where less sections are scheduled, the classroom may be designed as a multi-purpose room. It may serve as a planning center, resource center, library, and may be used for small group discussions as well as a classroom.

Individual laboratories within the industrial arts facility should be placed in position for the best physical arrangement and most effective intradepartmental activities. The general layout should be such that it is not necessary to pass through one laboratory to get to another.

Auxiliary spaces such as tool storage, material storage, finishing room, darkroom and office space need to be planned separately but in relationship to the main laboratory or module area. (See Figures 4, 5, 6, and 7). The location of auxiliary areas or rooms are generally

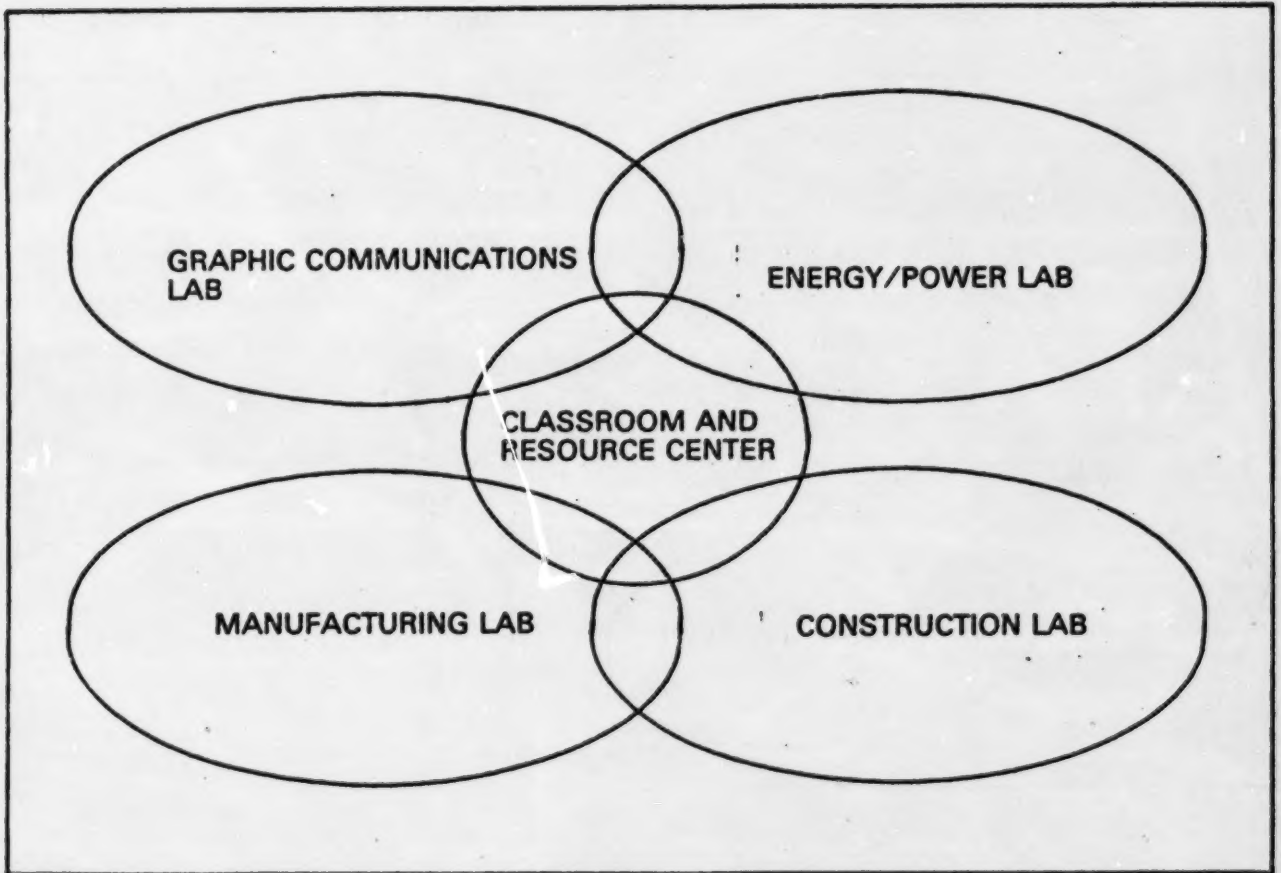


Figure 3: Space Relation Diagram

REPROGRAPHICS

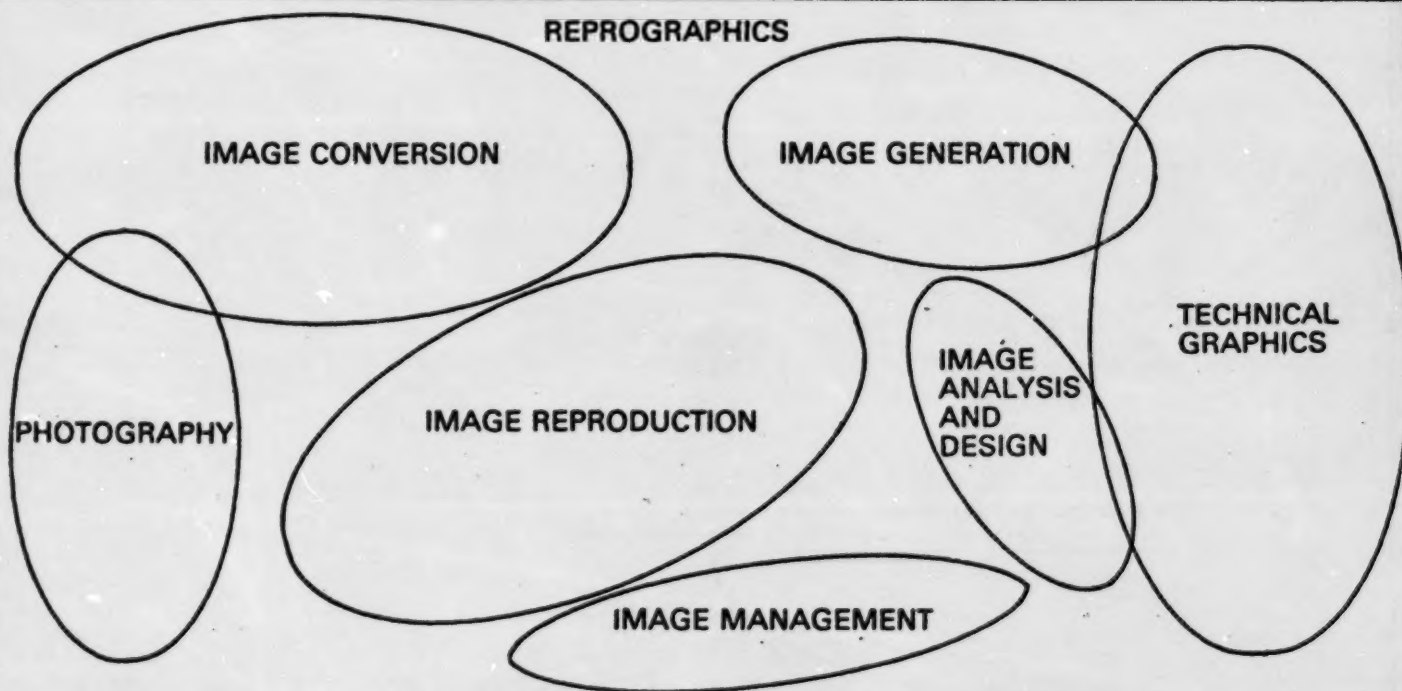


Figure 4: Space Relation Diagram For The Graphic Communications Cluster

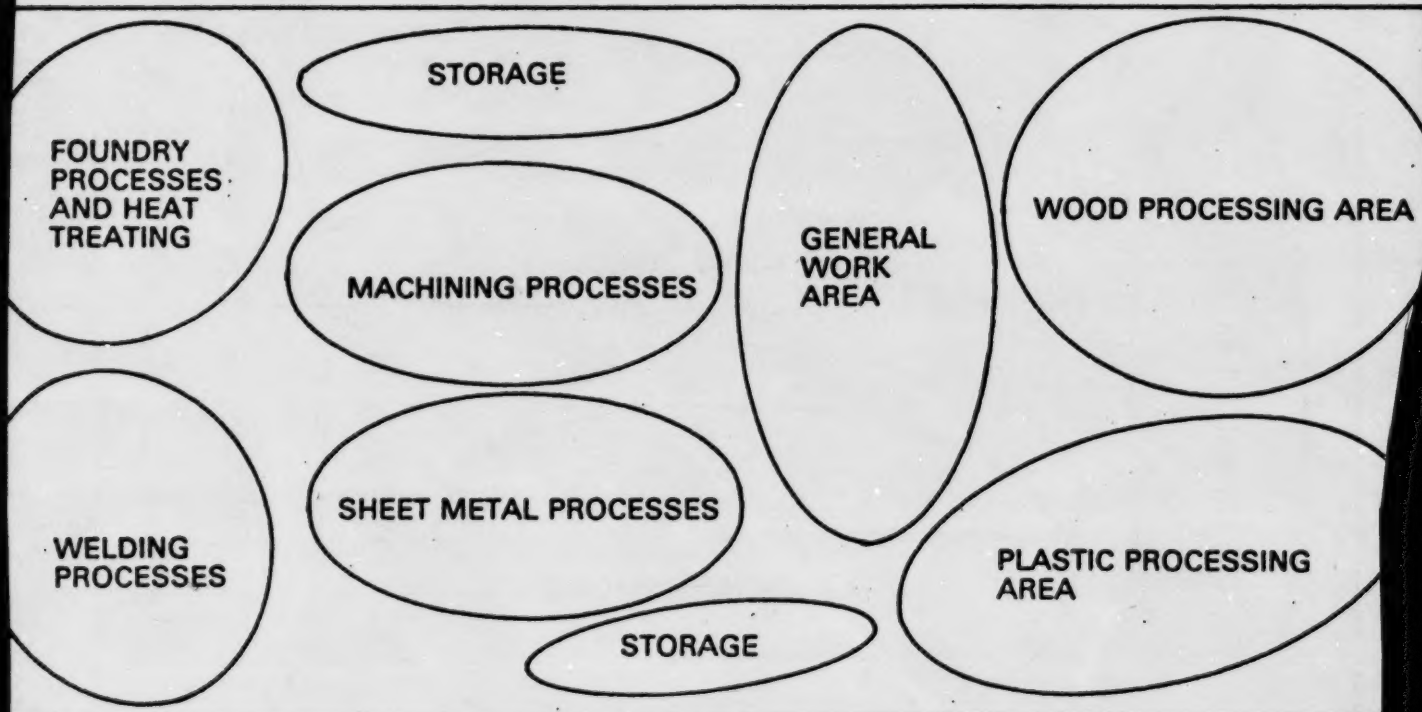


Figure 5: Space Relation Diagram For The Manufacturing Cluster

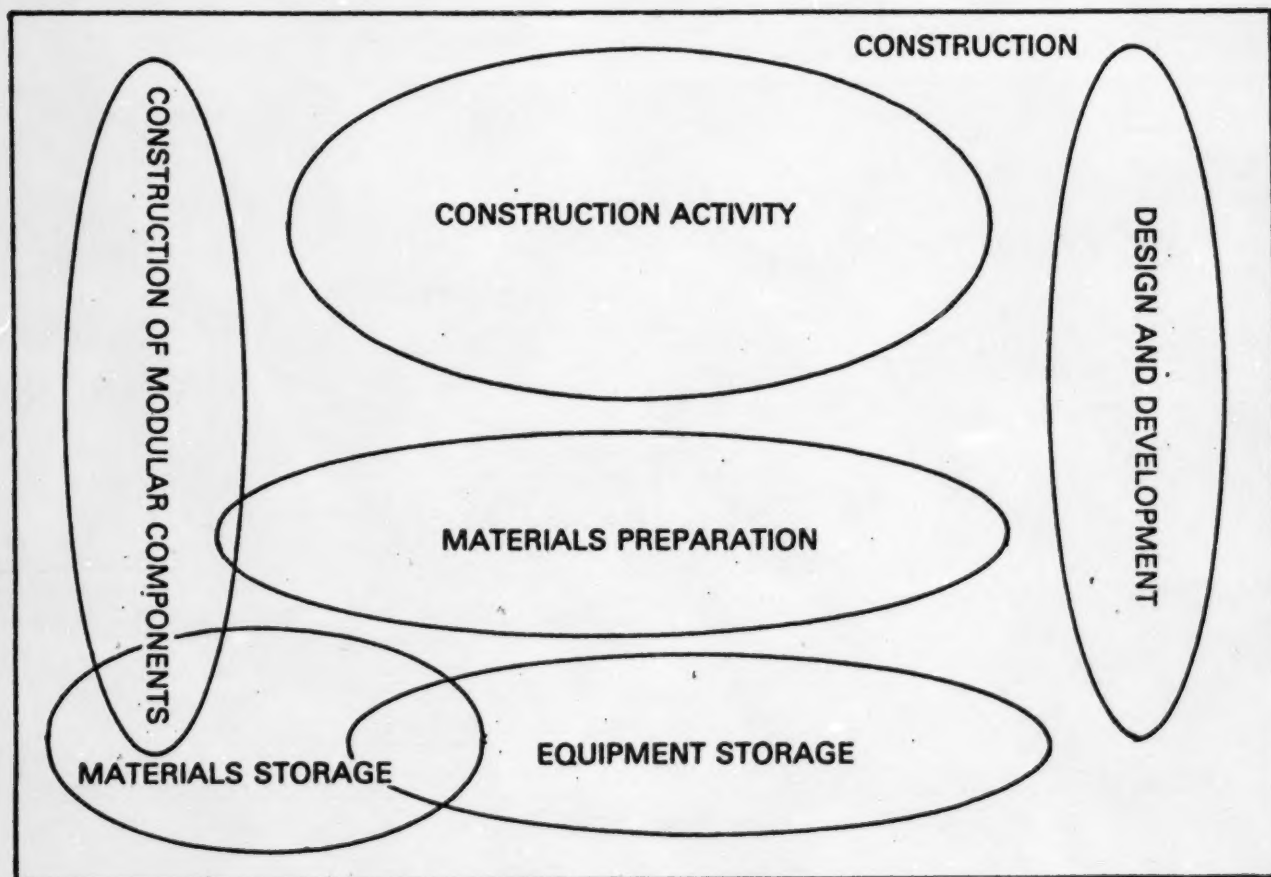


Figure 6: Space Relation Diagram For The Construction Cluster

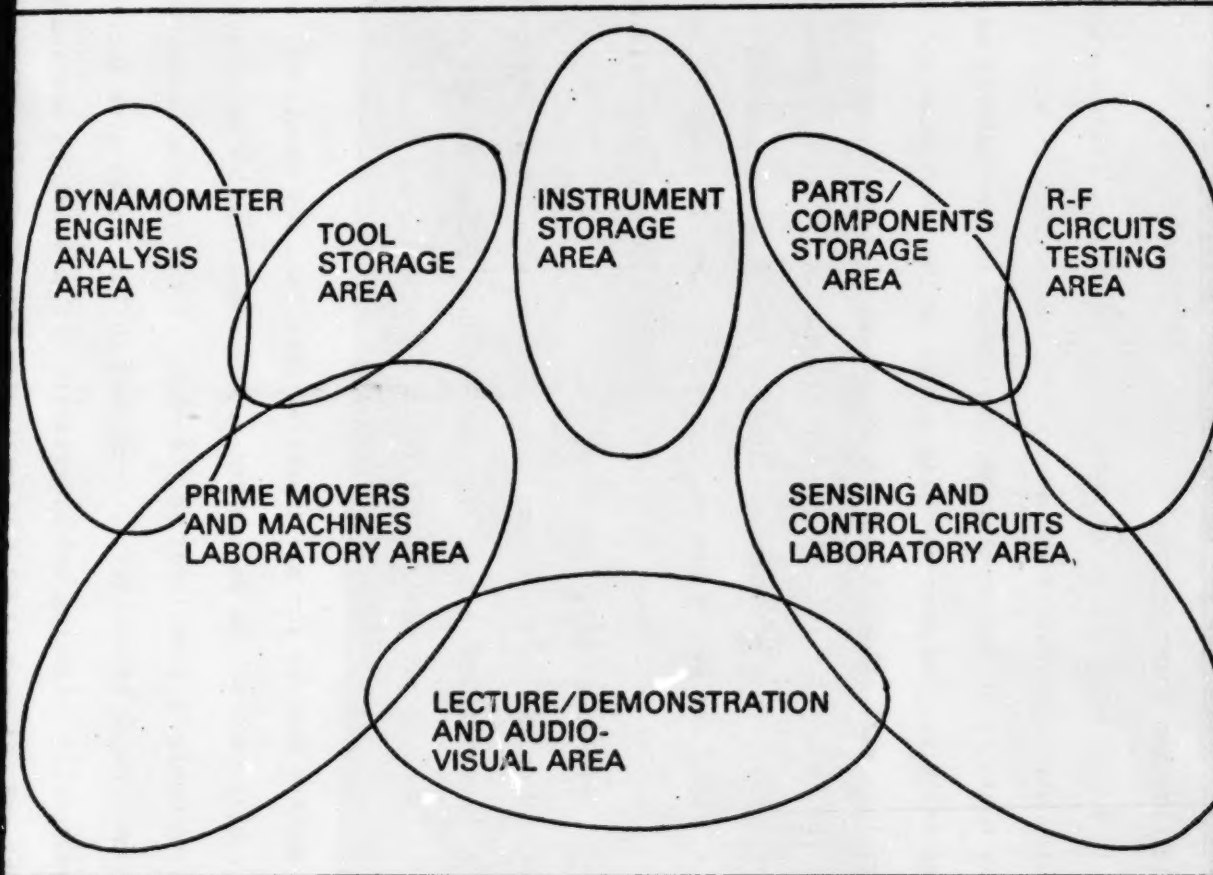


Figure 7: Space Relation Diagram For The Energy/Power Cluster

dictated by the internal laboratory layout in relation to work areas and processing areas.

General Considerations For Industrial Arts Facilities

FLEXIBILITY AND ADAPTABILITY

In a time when change is constant in education, laboratories must be built with flexibility and adaptability especially in mind. Due to the mobility of our population, enrollment in some schools may change rather rapidly. The ever-changing nature of the curriculum and teaching methodology will likewise require the utmost of flexibility in facilities. Among the items that will warrant consideration to assure flexibility are:

1. Partitions between laboratories should be non-bearing walls that are as free as possible of heating and plumbing installations. In some cases, it is recommended to use folding walls between related laboratory areas.
2. Overhead or floor type power grid with universal electrical connections, air supply grid and dust collection systems provide for a great deal of flexibility of functional facilities.

UTILITY SYSTEMS

Utility systems for an industrial arts facility should be considered an integral part of the design and not as appendages to be attached to a complete design and modified as the needs of the program become known. The common types of utility systems used in industrial arts include the following: 1) lighting and electrical; 2) water (both hot and cold); 3) gas; and 4) compressed air. Lighting and electrical and water is needed in all laboratories; whereas, gas and compressed air will be needed in the energy/power, manufacturing and construction laboratories. Allowances should be made for new additions and greater capacity required in the future.

Instructional Equipment Selection

PURCHASING EQUIPMENT

The major decision involved in the purchase of instructional equipment is its intended use. It is most critical that the teacher be aware of the curriculum and the activities which will be experienced based on program objectives. The educational specifications and selected learning activities determine the choices of equipment to be purchased.

Each piece of instructional equipment must be selected in terms of its potential for educational development of the student as well as a valid production function. In addition, criteria such as safety, durability, design, function, operating characteristics, versatility, accuracy and service should be carefully judged before purchasing a piece of equipment. The following considerations are significant in the assessment process:

1. Potentialities for student learning and development.
2. Ability to do the job it is designed to do.
3. Interface with students' physical and mental capabilities.
4. Ease and safety of operation.
5. Quality of electrical design and construction.
6. Quality of manufacturer.
7. Simplicity of design and structure.

REQUISITIONING EQUIPMENT

Once the selection has been made, the teacher needs to obtain specific and complete information about the item of equipment along with a list of reputable vendors. Selecting quality vendors who provide good service is essential in an efficiently operating industrial arts facility.

Requisitioning equipment is an important task in the purchasing process. Generally, the following items are included in the specifications:

(1) item model number; (2) quantity; (3) unit of measure; (4) manufacturer's or supplier's catalog number; (5) manufacturer's name; (6) name of items; (7) description as to size, color, voltage, amperage, phase, horsepower, etc. and accessories and/or equipment which are to be included.

Selection Criteria and Laboratory Layout

Equipment recommendations for industrial arts facilities must be prepared early in the planning stage. Space requirements must be known for each piece of equipment in order to plan for proper amounts of total space. The type, amount, and arrangement of equipment and furniture will naturally be influenced by the grade level for its intended use, curriculum offerings, and the method of instruction. The industrial arts teacher should be instrumental in selecting instructional equipment needed for each area to carry out the objectives of a program.

After the equipment items and furniture have been identified, it is recommended that a complete layout of all equipment and furniture be made by the instructor. A scaled drawing or the use of floor space cut-outs for each piece of equipment is most helpful. (See Figure 8). Through these means, an arrangement that will be safe and efficient can be determined. This layout is also necessary to plan for the necessary utility requirements within each of the laboratory areas.

The nature of the laboratory and the size of the enrollment will have a bearing on the physical layout of the instructional equipment within an industrial arts facility. However, the following general suggestions will be helpful in the arrangement of equipment in many situations:

1. All work stations must include sufficient floor area for the equipment and student, so the operations can be performed safely and without interference from the other work stations or laboratory traffic.

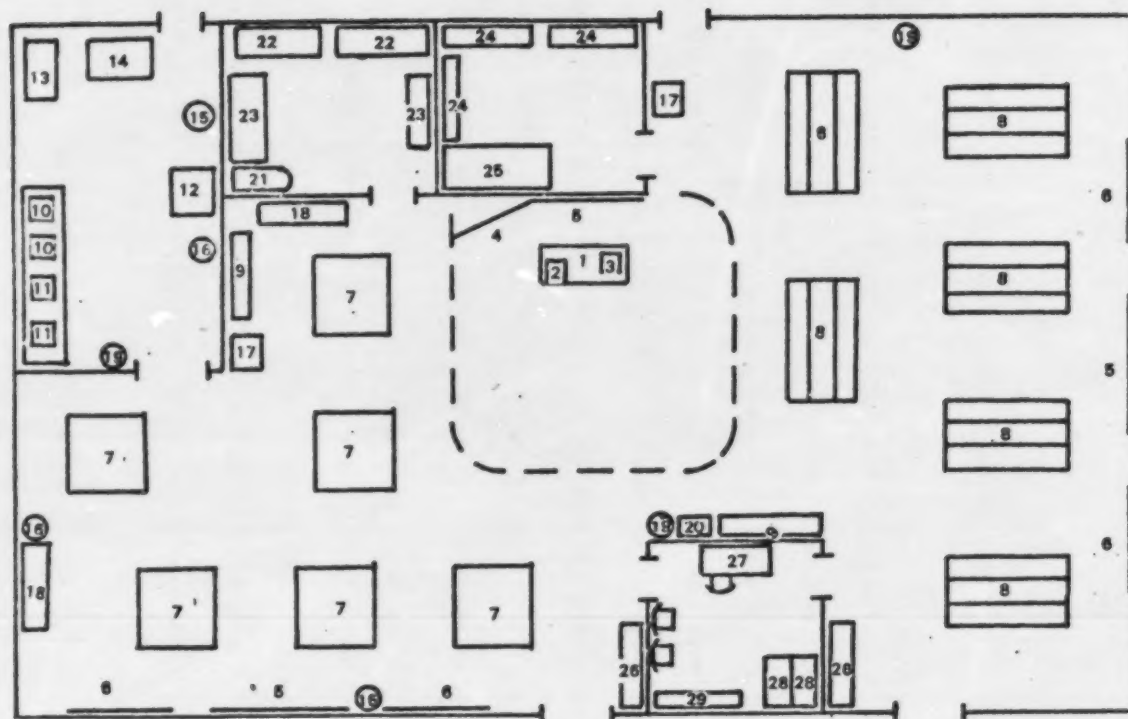


Figure 8: Equipment Layout Plan For A Junior High In Energy/Power

LEGEND

1. Demonstration desk
2. Overhead projector
3. Sink, s/s
4. Projection screen
5. Chalkboard
6. Tack board
7. Four-place bench for engines, mechanics, etc. exp.
8. Four-place, double-face bench, for electrical exp.
9. Book shelves
10. Demonstration engine, four-cycle
11. Demonstration engine, two-cycle
12. Dynamometer, small engine
13. Fuel and lubricant storage
14. Parts cleaning tank
15. Waste oil container
16. Rag disposal container
17. Refuse disposal can
18. Hand-tool storage cabinet
19. Fire extinguisher
20. First aid and fire blanket
21. Air compressor
22. Test instrument storage
23. Demonstration model and power tool storage
24. Rack-bin storage
25. Instructor's repair and maintenance bench
26. Display cabinet
27. Instructor's desk
28. File cabinet
29. Instructor's reference and library shelving

2. Hazardous work stations and equipment should be "pocketed" and otherwise protected to isolate the worker and to insure safety to other students in the laboratory to minimize the possibility of accidents. These stations may be located some distance from the main entrance and away from major traffic lanes.
3. The equipment should be arranged so that the material being processed does not interfere with other work stations or laboratory traffic. Position equipment to allow for material clearance such as saws, planers, and jointers require 12 to 16 feet front and back.
4. Arrange tall equipment so that visual control throughout the laboratory will not be obstructed.
5. Arrange equipment having related operations so the proper sequence of work can be easily followed with a minimum of student and material movement.
6. Position equipment to provide for safe operation by the operator and to protect other students. For example, the circular saw must be located so that a kick-back will not endanger other students.
7. Provide distinct travel aisles between major areas such as supply center, storage, tool centers, planning areas, and entrances. Heavy traffic areas should be at least four feet wide. Operators should not be in traffic aisles when operating equipment.
8. Arrange work stations, tool panels, and supply centers so the operations and processes of an activity can be carried out by the students with a minimum of travel.

9. Provide extra space where students tend to congregate, such as around lockers, entrances, and tool panels.
10. Group equipment that have similar requirements for dust collection, ventilation, power, air or gas. Adequate ventilating hoods are also essential.
11. Provide work surfaces next to equipment such as drill presses, jointers, shapers and saws where additional work pieces can be stacked.
12. Arrange equipment so that it can be easily cleaned, maintained and serviced.
13. When locating equipment, be certain to include and show on drawings special features necessary for safe and efficient operation. For example, arc welding must be confined to some kind of a booth because of the harmful flash.

SUMMARY

The goal of environmental design is to provide facilities that will support and enhance the curricular programs and instructional actions. The model of an environmental system for learning in industrial arts includes four components: (1) physical facilities; (2) instructional equipment; (3) laboratories supplies and materials; and (4) the learner. The latter is the most important of the four components since our objective is to prepare individuals for the future. The other three components are essential within the learning system since they affect the learner as he/she functions and interacts within the environment.

The laboratory environment in which an industrial arts student studies can have a significant effect on the learner's well-being, health, attitude, quantity and quality of work performed and the retention of learning. Every measure must be taken to assure that good visual, auditory,

and provisions for social interactions are taken into account in the design of the total physical learning environment. These considerations and others are essential to provide a physical facility that will effectively serve students through dynamic and stimulating programs in industrial arts education.

Industrial arts is a study of industry and its associated technology. They require an industrial/technological environment in an educational setting. Proper planning of the learning environment is a serious responsibility if the investment is to be sound and the educational program productive.

The handbook on educational and facility specifications, developed by this project, is intended to serve as a guide to secondary schools in the preparation of educational specifications for industrial arts facilities.

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